

**FEDERAL AID
ANNUAL RESEARCH PERFORMANCE REPORT**

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 25526
Juneau, AK 99802-5526

PROJECT TITLE: Assessing wildland fire impacts on the nutritional performance and distribution of caribou within Alaska's boreal forest ecosystem

PRINCIPAL INVESTIGATOR: Bruce W. Dale

COOPERATORS: K. Joly and L. Adams (U.S. Geological Survey)

FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NR: W-33-3

PROJECT NR: 3.44

WORK LOCATION: GMU 11, 12, 13 and 20E: The Nelchina, Copper and Upper Tanana River Drainages

STATE: Alaska

PERIOD: 1 July 2004–30 June 2005

I. PROGRESS ON PROJECT OBJECTIVES SINCE PROJECT INCEPTION

Note: The project statement was amended during the 2003 segment period. Changes included a change in title and several objectives to reflect the ongoing collaboration between U.S. Geological Survey and ADF&G in studying the influence of wildland fire on caribou.

OBJECTIVE 1: Determine the nutritional status of 4 cohorts of female caribou prior to their first winter.

We completed evaluation of the nutritional status of 4 cohorts of female caribou in October 2003.

OBJECTIVE 2: Determine distribution and habitat use (relative to fire history and lichen abundance) of female caribou during their first winter.

By the end of this segment period, we have determined and analyzed the monthly distribution and habitat use of approximately 100 caribou for each of the last 4 years. Caribou avoided recent fires and most caribou apparently selected habitats with abundant fruticose lichens in

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Please note: This is a progress report and the information contained within may be further analyzed and refined.

winter. Caribou using the western winter range had superior nutritional performance over winter. However, the northern winter range was the most important to the population, based on both nutritional performance and relative use. We generated one draft manuscript on this topic. That manuscript is in peer review and should be submitted within the first few months of the next reporting period.

OBJECTIVE 3: Determine seasonal changes in body mass of young female caribou to evaluate the influence of fire history and lichen abundance on nutritional performance.

We collected the final data in October 2003. Summer weight change had a much greater influence on weight at 11 and 16 months than winter weight change. However, winter change in body mass has not been greater than zero since 1998, even though snow depths have been below average, suggesting that winter resources are becoming more limited. We generated one draft manuscript on this topic. That manuscript is in co-author and peer review and should be submitted within the first few months of the next reporting period.

OBJECTIVE 4: Evaluate influences of density, distribution, and habitat indices on changes in body mass.

We continued developing indices and summarized body mass data and have begun analyses and writing. Winter and summer distributions varied during the third year from the patterns seen during the first 2 years. The fourth year winter distribution was similar to the first 2 winters. Fewer caribou wintered on the current winter range, and caribou were more disbursed during summer during the third year. Summer body weights, which were higher in the third year, returned to values similar to previous years.

OBJECTIVE 5: Evaluate relationships between distribution and survival.

We completed development of distribution indices and summarized annual survival data. We incorporated survival patterns into a manuscript with those from Objective 4. That manuscript is currently in draft form.

II. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN THIS PERIOD

Job/Activity 1 (a). Capture and weigh at least 30 female caribou calves during the peak of calving

Activity not scheduled for this reporting period.

Job/Activity 1 (b). Capture, weigh, measure body parameters, radiocollar and collect blood samples from 40 5-month-old female caribou.

Activity not scheduled for this reporting period.

Job/Activity 2 (a). Conduct periodic aerial-radio-telemetry flights.

Activity not scheduled for this reporting period.

Job/Activity 3 (a). Recapture individual female caribou calves in April after their first winter and in October after their second summer.

Activity not scheduled for this reporting period.

Job/Activity 3 (b). Capture additional caribou, evaluate their nutritional status and fit with radiotransmitters as necessary to maintain sample sizes within each cohort.

Activity not scheduled for this reporting period.

Job/Activity 3 (c). Evaluate nutritional status and remove transmitters from caribou at 16-months of age.

Activity not scheduled for this reporting period.

Job/Activity 4 (a). Calculate distribution indices and compare to nutritional performance measures via appropriate regression techniques.

Activity not scheduled for this reporting period.

Job/Activity 5 (a). Calculate Kaplan-Meier survival estimates to describe basic survival functions of each cohort. Use logistic regression to evaluate the relationship between the density and distribution indices and probability of survival.

We summarized annual survival estimates for the year and compared these estimates to data from previous years. We evaluated relationships between density and survival and are incorporating those findings in a manuscript during the next reporting period. We ended up using Cox-Proportional Hazard models rather than Kaplan-Meier estimates to evaluate patterns in survival.

Job 6. Analyze data and publish reports.

Data are being analyzed and reports were produced. Two manuscripts are in peer and co-author review. A third manuscript is in draft form. See Publications section.

III. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THIS SEGMENT PERIOD

IV. PUBLICATIONS

Two manuscripts are in peer and co-author review. A third manuscript is in draft form. The 3 manuscripts are described below:

1. Dale, B. W., L. G. Adams, W. B. Collins, K. Joly, P. Valkenburg, and R. Tobey. Seasonal, stochastic, and compensatory effects limit persistence of variation in body mass during growth of female caribou.

Abstract. Nutritional restriction during growth can have short and long term effects on fitness; however, animals inhabiting uncertain environments may exhibit adaptations to cope with variation in food availability. We examined change in body mass in wild, free-ranging female caribou by obtaining measures of mass at birth, 4, 11, and 16 months of age to evaluate the relative importance of seasonal (summer vs. winter) nutritional performance to somatic growth, the persistence of cohort-specific variation in body mass through time, and compensatory growth of individuals. Body mass at end of summer varied more than at end of winter. Second summer foraging conditions had the greatest influence on body mass at age 16 months. Thus, among cohorts, light 4-month-old calves could attain or surpass mean body size of other cohorts by age 16 months. Compensatory growth of smaller individuals was not observed in summer; however smaller calves lost less weight over winter. Compensation occurred during periods of nutritional restriction (winter) rather than during periods of rapid growth (summer) thus differing from the conventional view of compensatory growth. The observed mechanism may actually be mistaken for conventional compensatory growth in field studies, has a simpler basis in allometric variation in metabolic rates, may not incur subsequent long-term reductions in fitness, and implicates selection for optimum, rather than large, body size during growth in uncertain environments. Cohort specific and individual body size at birth and age 4 months may not persist into adulthood depending on summer foraging conditions.

2. Dale B.W., L. G. Adams, K. Joly, and W. B. Collins. Spatial variation in nutritional performance indicates constraints on caribou distribution relative to forage resources and allows ranking the value of discrete habitats.

Abstract. Resource selection functions can be problematic for identifying and evaluating critical habitats especially if animals are not freely distributed relative to resources. To determine the value of discrete winter habitats and forage lichen resources to caribou, we evaluated spatial variation in winter nutritional performance of individual female caribou calves. We found significant spatial variation in nutritional performance indicating that caribou were not freely distributed relative to resources. We ranked habitats based on performance of individuals and importance to the population.

3. Collins, W. B., B. W. Dale, D. E. McElwain, K. Joly, and L. G. Adams. Fire, Lichen Abundance, Grazing History, and Distribution of Barren-ground Caribou in Alaska's Taiga.

V. RECOMMENDATIONS FOR THIS PROJECT

VI. APPENDIX

A manuscript describing caribou movements relative to fire history was completed and published by Canadian Journal of Zoology. It was reported during the previous period. We now present title and abstract below. A related manuscript written by S. Rupp at University of Alaska Fairbanks has been accepted for publication in Ecological Applications.

1. Joly, K., B. W. Dale, W. B. Collins, and L. G. Adams. 2003. Winter habitat use by female caribou in relation to wildland fires in interior Alaska. Canadian Journal of Zoology, 81(7):1192–1201. ISSN: 0008-4301

Abstract:

The role of wildland fire in the winter habitat use of caribou (*Rangifer tarandus*) has long been debated. Fire has been viewed as detrimental to caribou because it destroys the slow-growing climax forage lichens that caribou utilize in winter. Other researchers argued that caribou were not reliant on lichens and that fire may be beneficial, even in the short term. We evaluated the distribution of caribou relative to recent fires (<50 years old) within the current winter range of the Nelchina caribou herd in east-central Alaska. To address issues concerning independence and spatial and temporal scales, we used both conventional very high frequency and global positioning system telemetry to estimate caribou use relative to recent, known-aged burns. In addition, we used two methods to estimate availability of different habitat classes. Caribou used recently burned areas much less than expected, regardless of methodologies used. Moreover, within burns, caribou were more likely to use habitat within 500 m of the burn perimeter than core areas. Methods for determining use and availability did not have large influences on our measures of habitat selectivity.

2. Rupp, S., M. Olson, L. G. Adams, B. W. Dale, K. Joly, J. Henkelman, W. B. Collins, and A. Starfield. Simulating the Influence of a Changing Fire Regime on Caribou Winter Foraging Habitat. Ecological Applications.

Abstract: Caribou are an integral component of high latitude ecosystems – representing a major subsistence food source for many northern people. The availability and quality of winter forage habitat is critical to the continued success of these caribou populations. Changes in climate and fire regime pose a significant threat to the long-term sustainability of this important winter habitat. Our computer simulations that were performed using a spatially explicit vegetation succession model (ALFRESCO) indicate that changes in the frequency and extent of fire in interior Alaska may substantially impact the winter habitat of caribou. We modeled four different fire frequency scenarios and tracked the frequency, extent, and spatial distribution of the simulated fires and associated changes to vegetation composition and distribution. Our results suggest that shorter fire frequencies (i.e., more frequent fires) on the winter range of the Nelchina Caribou Herd in eastern interior Alaska will result in large decreases of available foraging habitat, relative to currently available habitat, in both the short- and long-term future. A 30% shortening of the fire frequency resulted in a 72% increase in annual total area burned and an associated 41% decrease in the

amount of spruce-lichen forest found on the landscape. More importantly, simulations with more frequent fires produced a relatively immature age structure, relative to the currently observed age structure, with few forest age classes older than 100 yr. This age structure is at the lower limits of preferred stand age classes based on observations of forage selectivity by caribou from the Nelchina Caribou Herd. Projected changes in fire regime due to climate warming and/or altering prescribed burning management could substantially alter the winter foraging habitat of caribou in interior Alaska and lead to changes in winter range use and/or population dynamics.

VII. PROJECT COSTS FOR THIS SEGMENT PERIOD

Stewardship Investment items purchased: *list any equipment or other items purchased for which the cost of the individual item was \$5,000 or more (include cost)*

None

FEDERAL AID SHARE \$3750 STATE SHARE \$1250 = TOTAL \$5,000

VIII. PREPARED BY:

Bruce W. Dale
Wildlife Biologist III

SUBMITTED BY:

Earl Becker
Research Coordinator